

# The **MARIACHI** Project

*Forefront Science by Scientists, Teachers, and  
Students*

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and Public Outreach  
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<http://www-mariachi.physics.sunysb.edu/>





## Scientists

Practice Science  
Poor Social Skills  
Brain washed



## Teachers

Educate  
Good Social Skills  
Structured Career



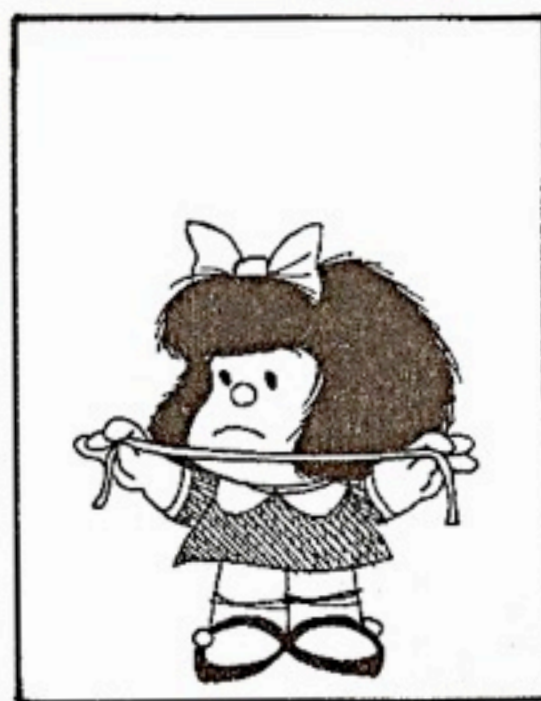
## Students

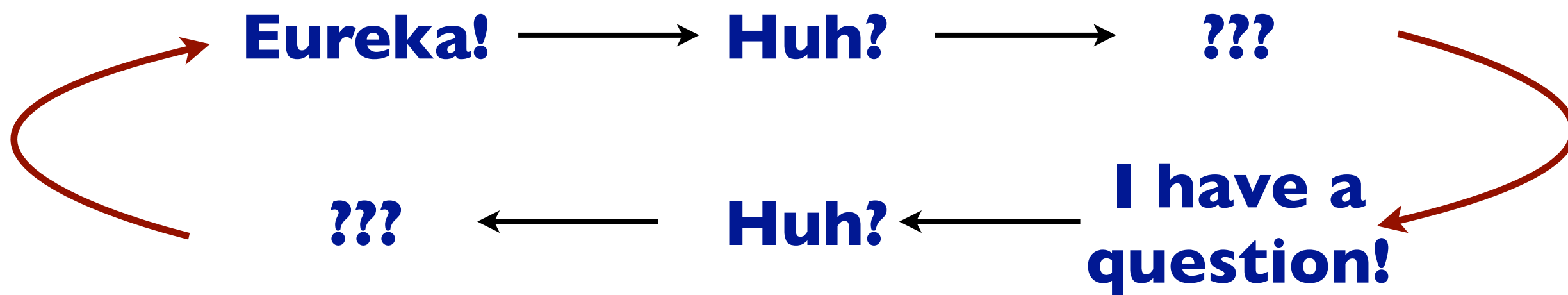
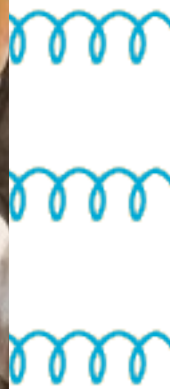
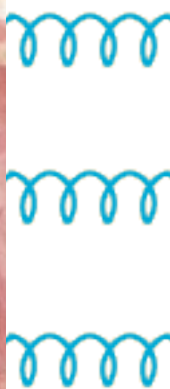
High Expectations!

## Knowledge

Authentic Science in the classroom







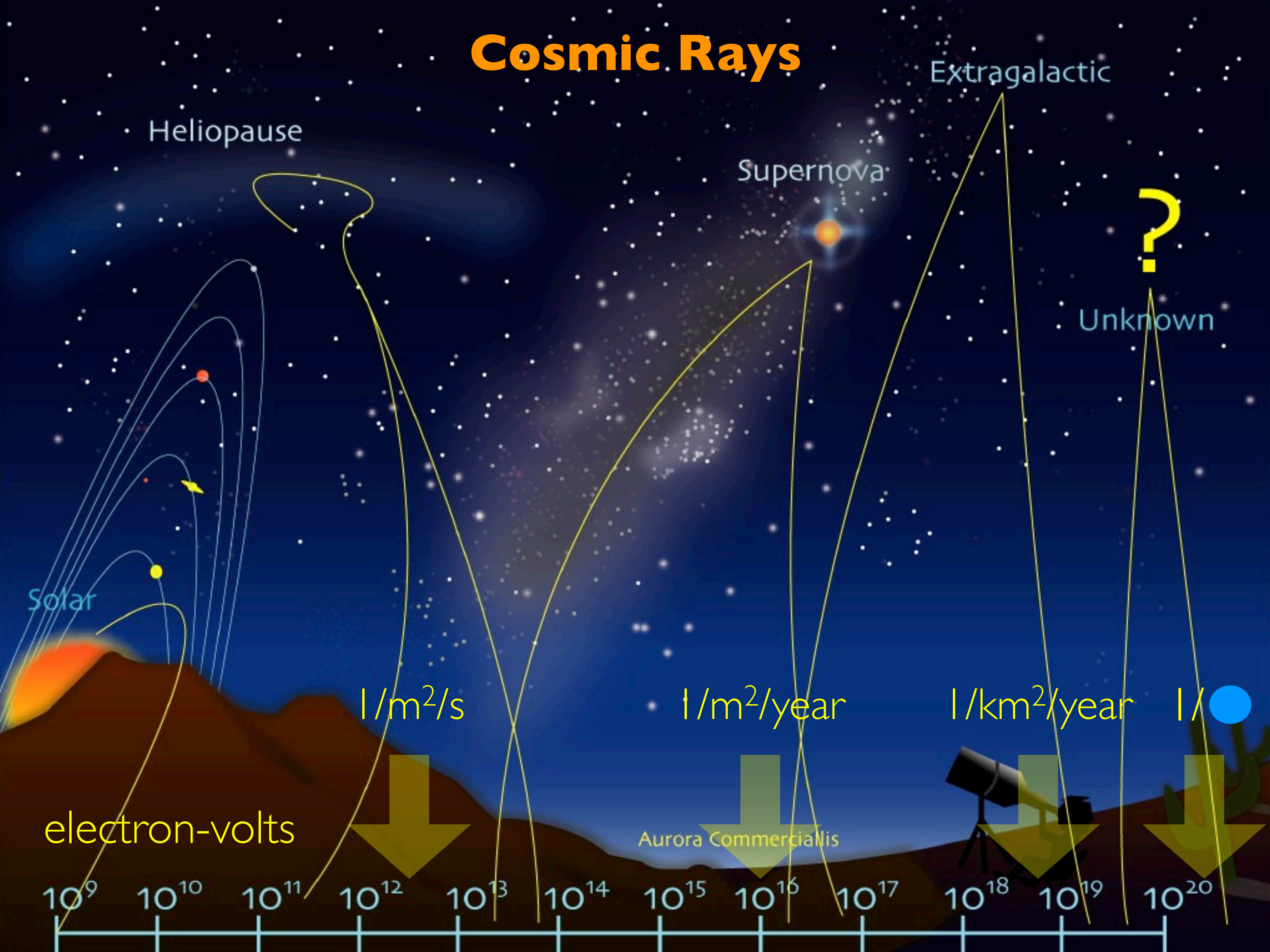


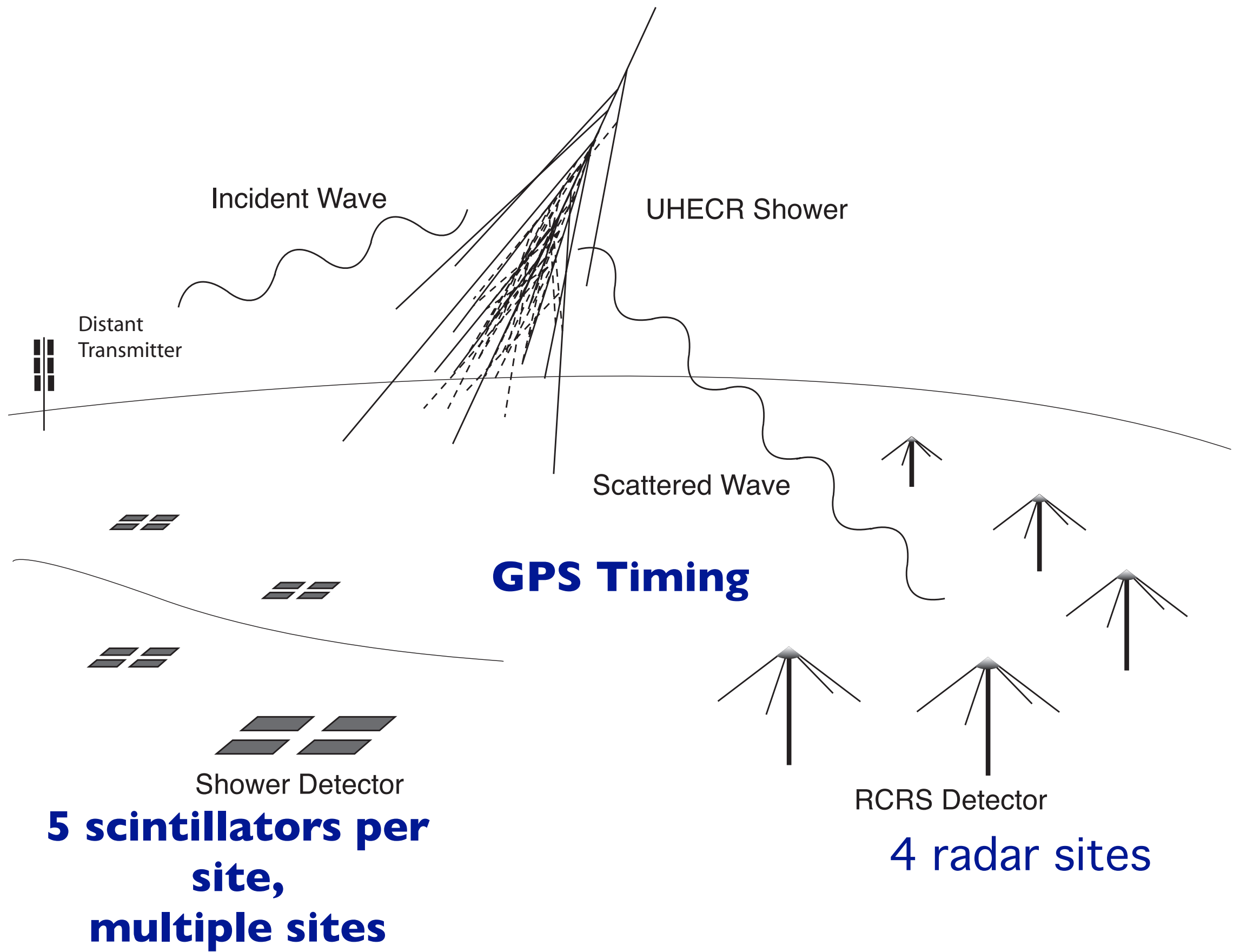


**Science !**



# Cosmic Rays









Scintillator

The image shows a black, ruggedized, lockable case, likely a Pelican brand, which is open. Inside the case, there is a large, white, rectangular object labeled 'Scintillator'. To the right of the scintillator, there is a cylindrical object labeled 'See-through PMT assembly'. The case is sitting on a dark, reflective surface. In the background, there are some electronic devices and a box labeled 'hp deskjet 6122'.

See-through  
PMT assembly

Light-tight  
student proof  
lockable case

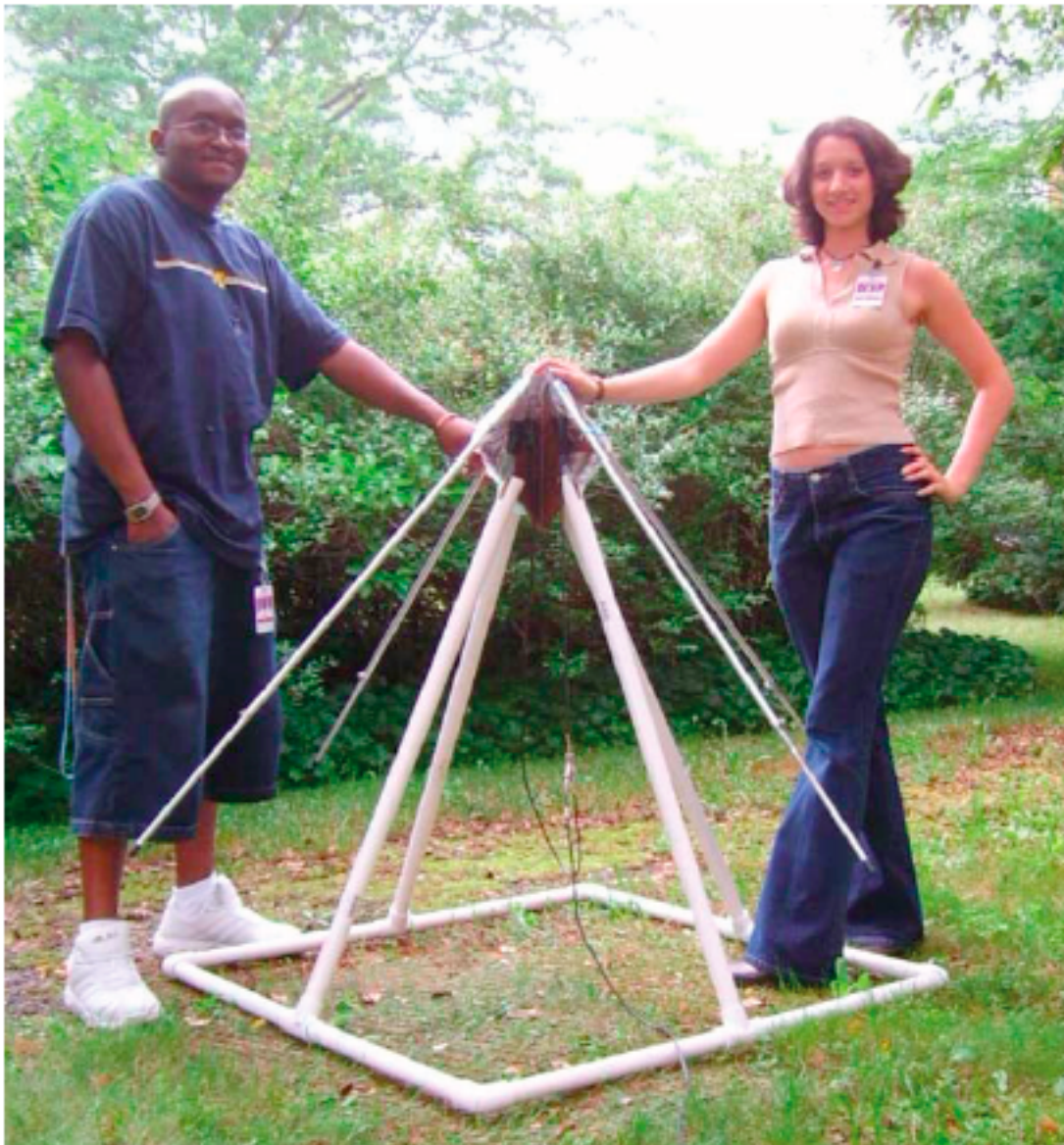




<http://www.custerobservatory.org>

SPIDA - Simple Prototype Inverted Dipole Antenna

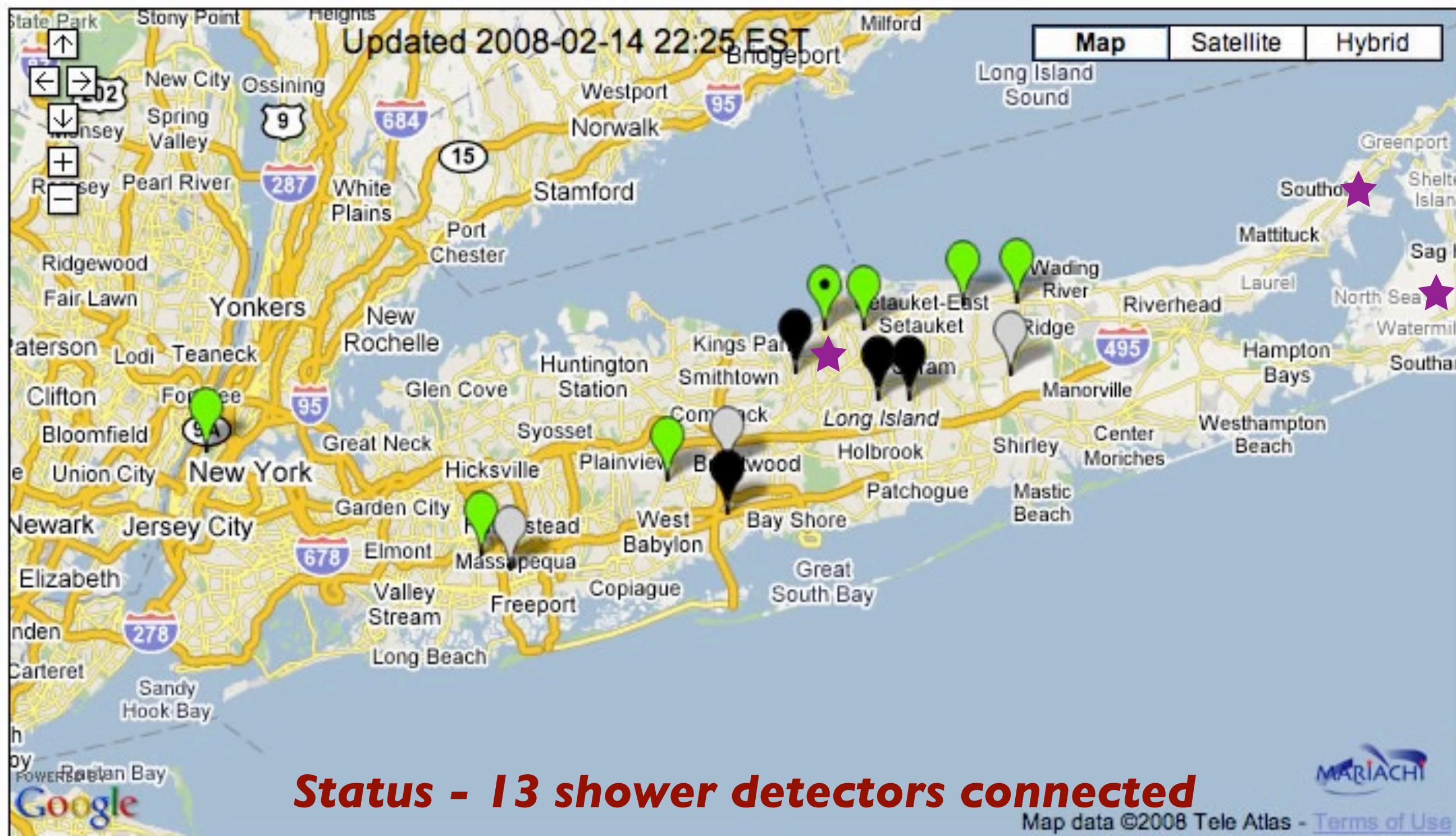




Prototype \$3.50, SPIDA 2 \$100,  
Picture of SPIDA from Brazil - priceless



# Mixed Apparatus for Radar Investigation of Atmospheric Cosmic-rays of High Ionization



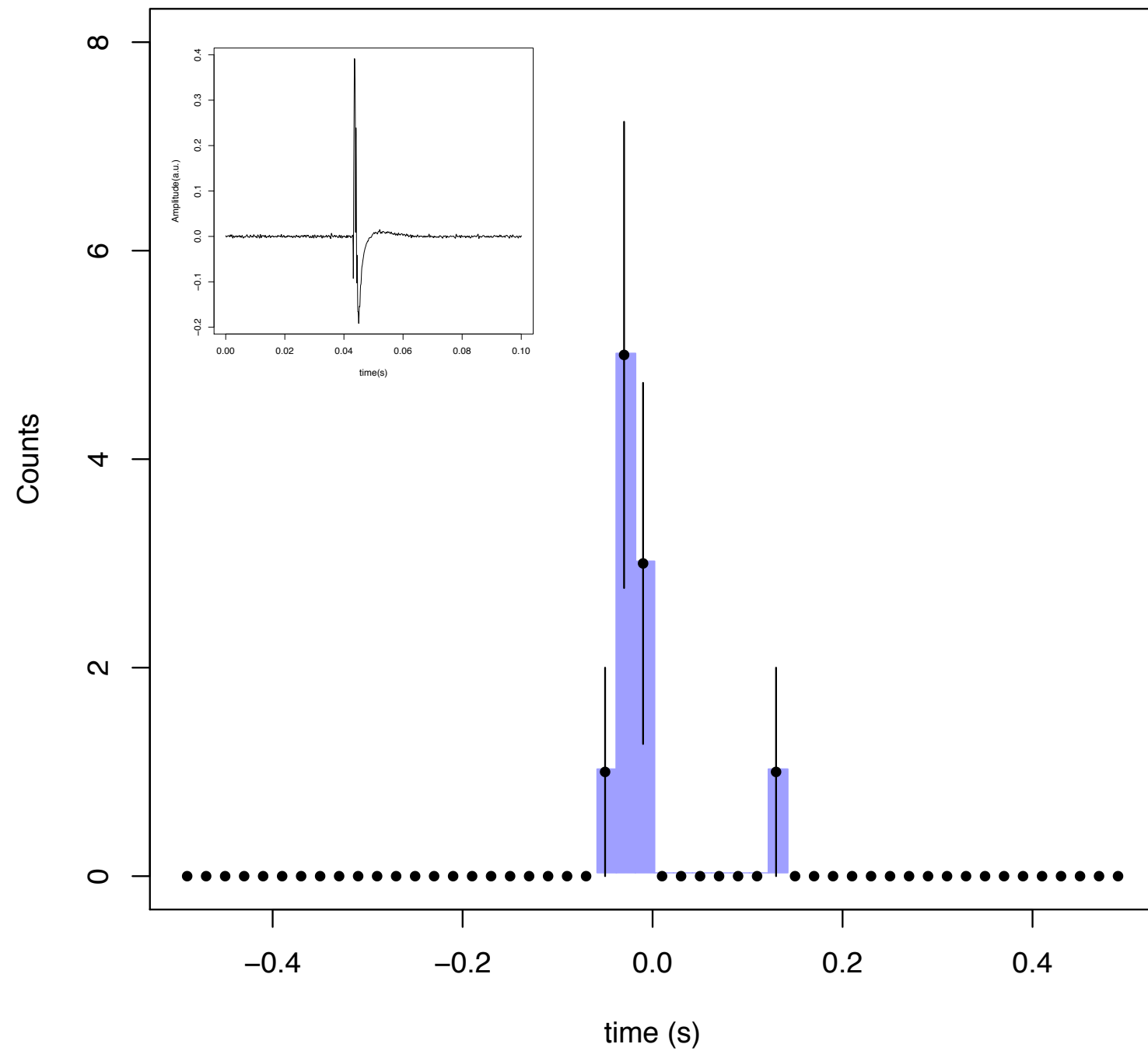




**Science Results?**



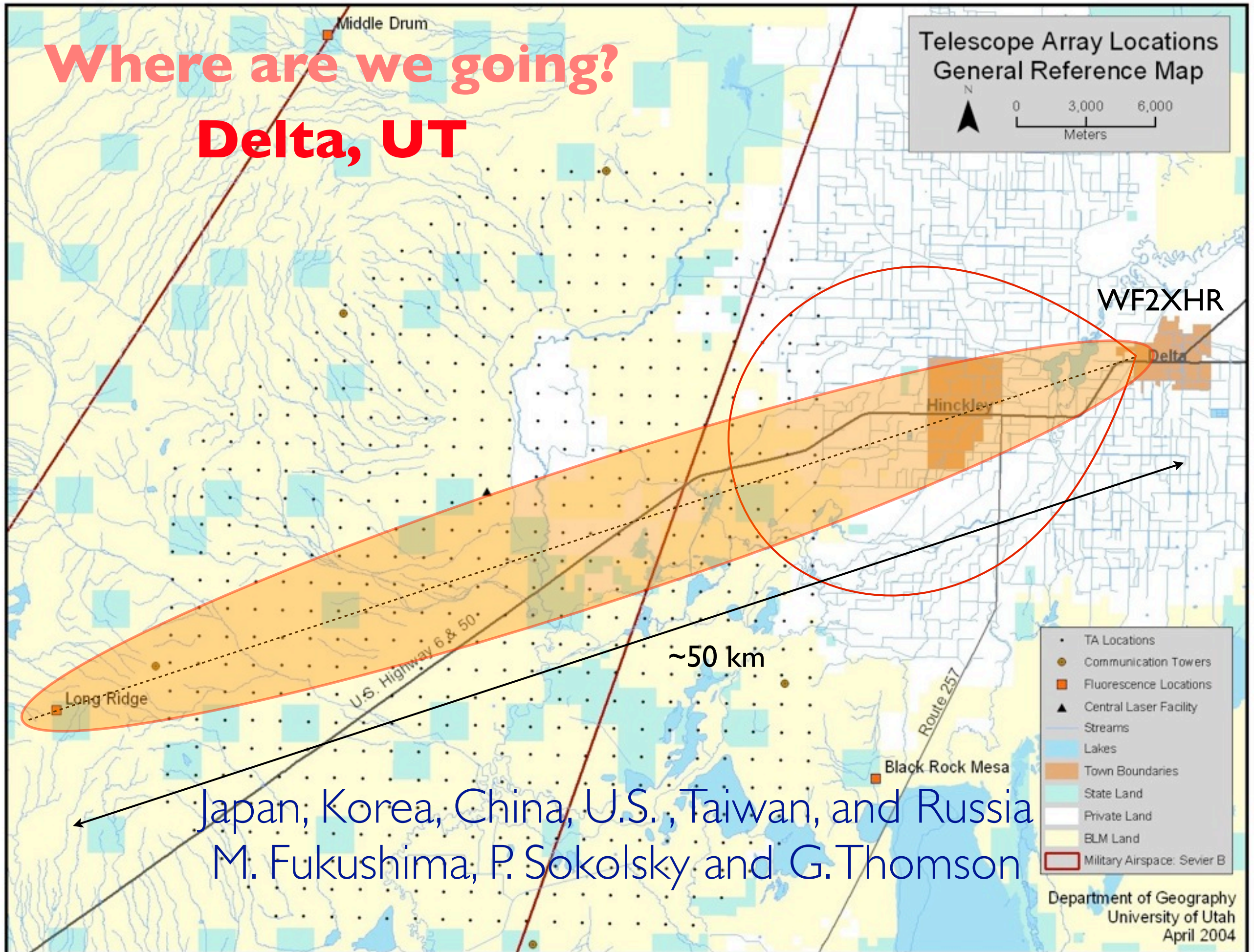
Radar-scintillator coincidences found in 2 weeks of run.



**Are they Real??**



# Where are we going? Delta, UT



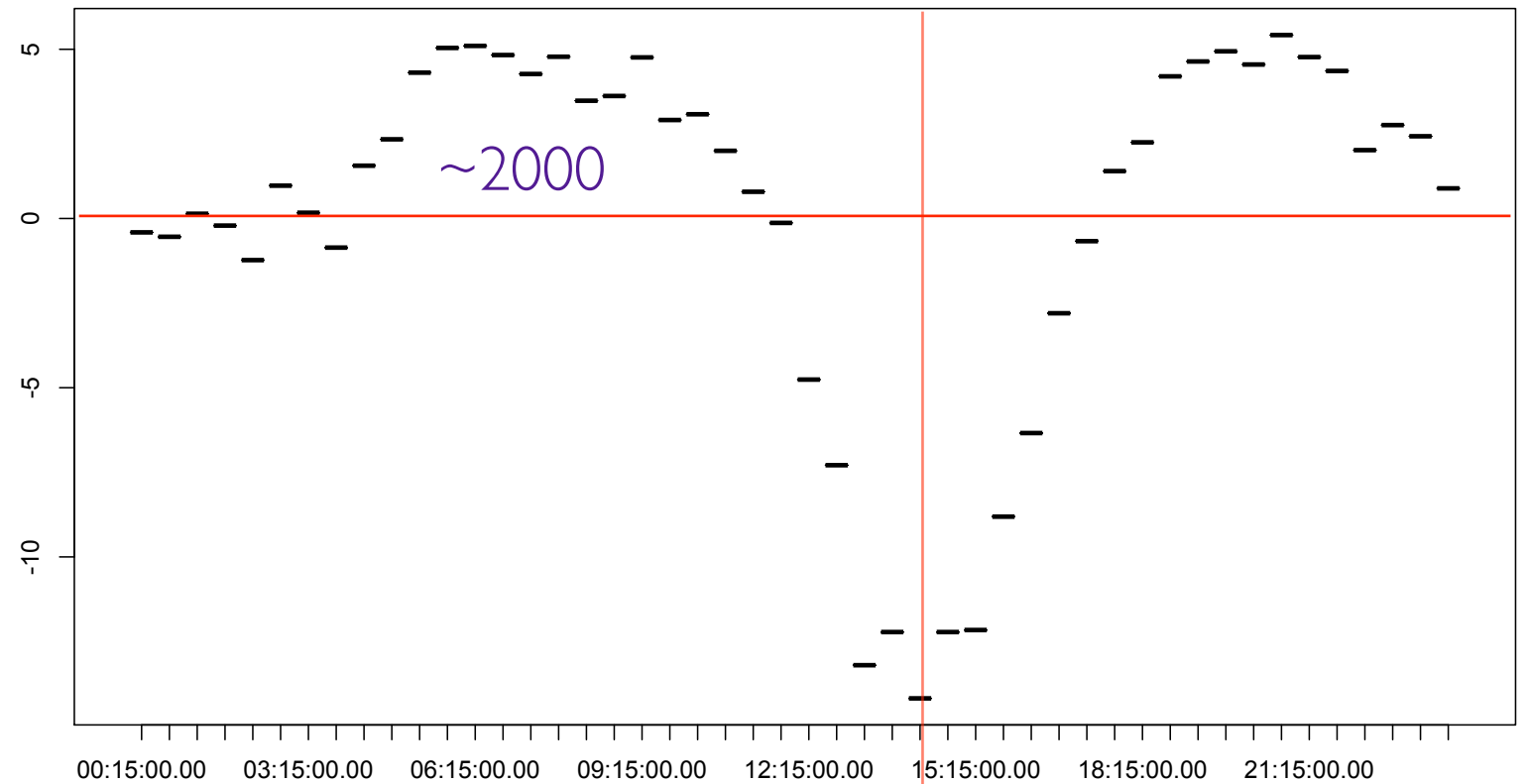




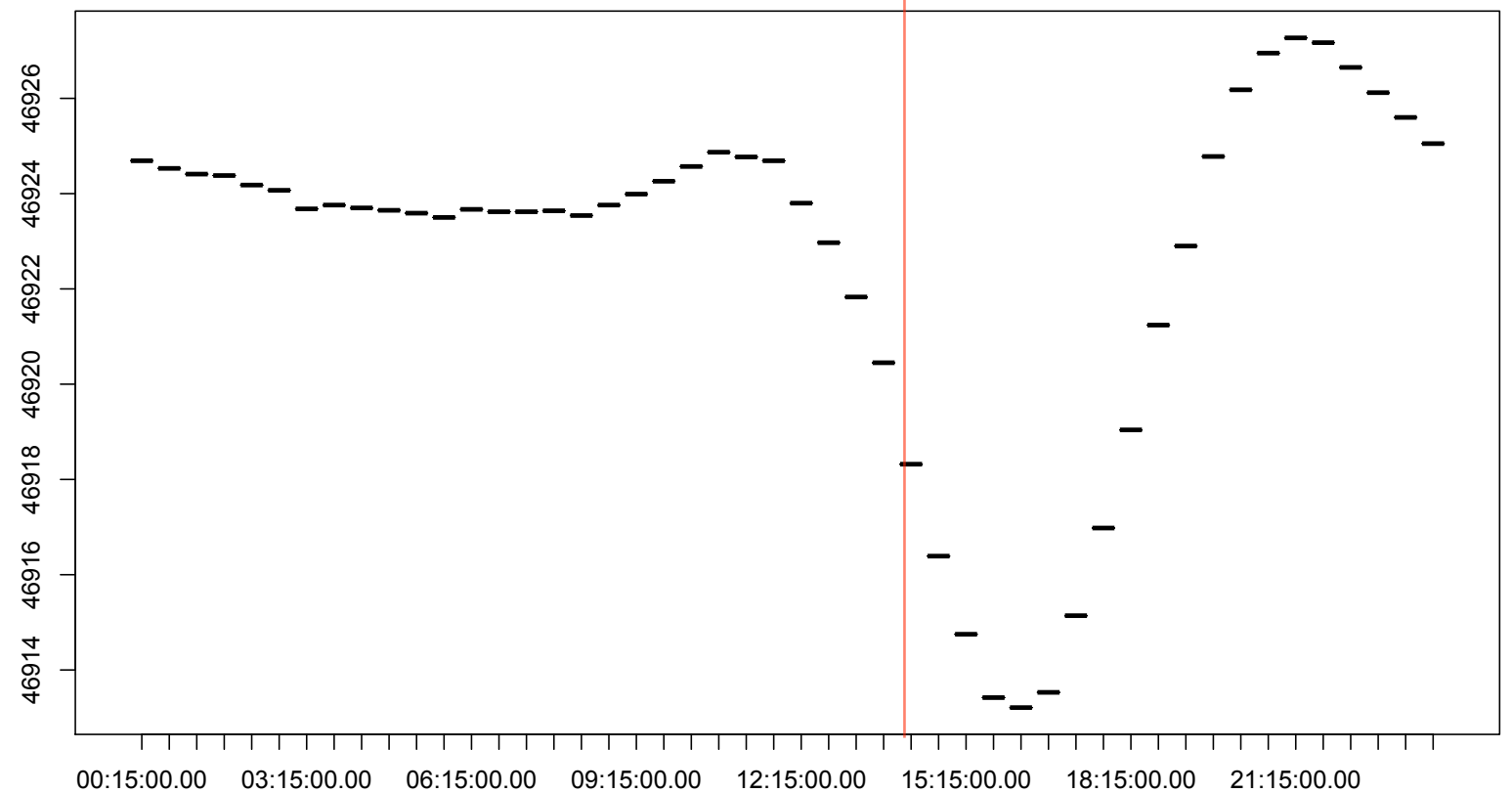


# 6 month averages

Cosmic ray  
measurement at  
Smithtown HS East



Geomagnetic Field at  
Fredericksburg, VA



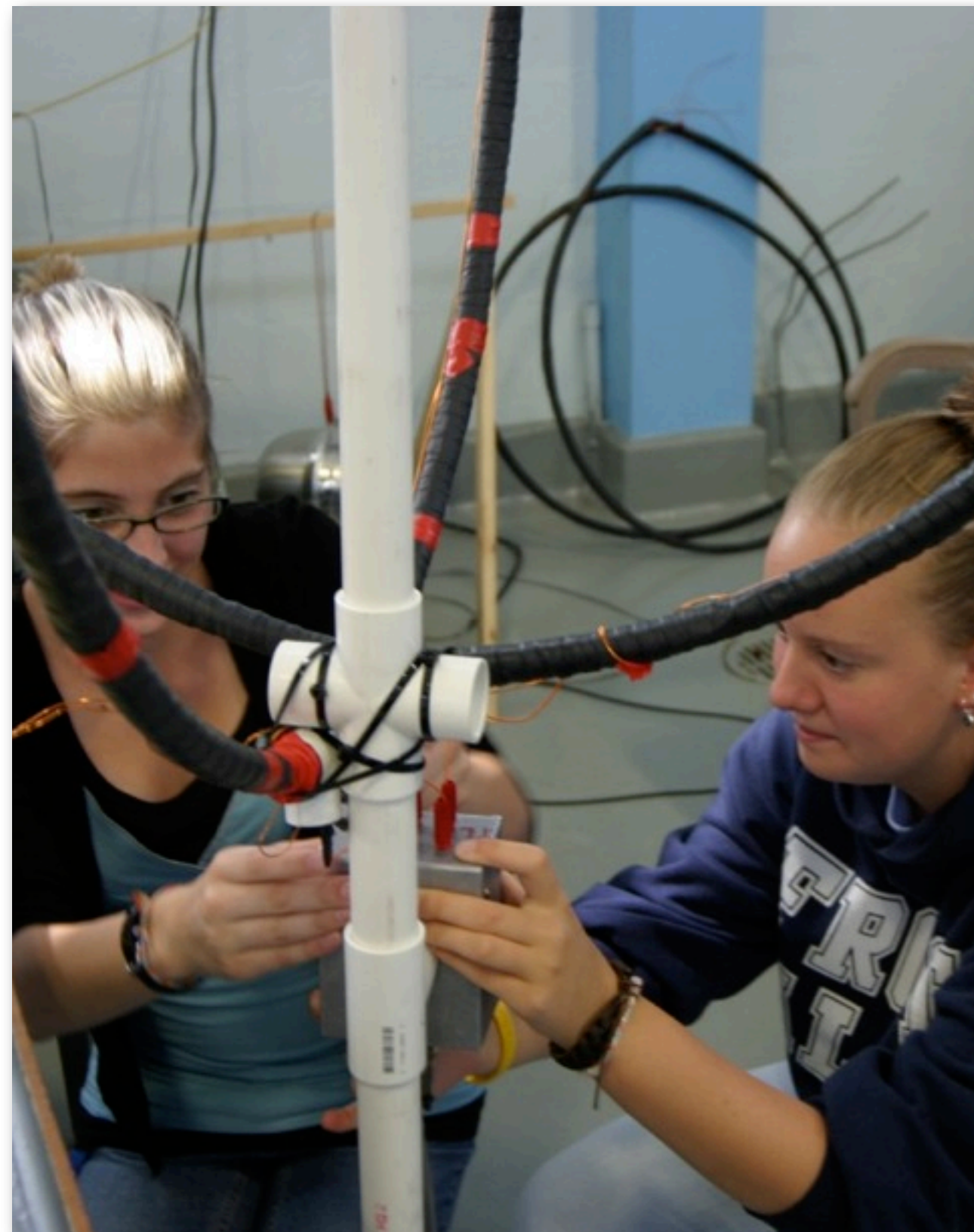


The electric Earth

*Astronomy and Geophysics*, 43:6.9-6.12, 2002

# Cosmic influences on the atmosphere

A new generation of tools for examining the global atmosphere is transforming our understanding of the role of electricity in the Earth's climate. Neil Arnold and Torsten Neubert review this developing field.







**Educational Results?**





**The Nerd** - Wants to do research projects, will spend summers working at research institutions



**The Enthusiast** - Really loves science, will participate in short term projects, but wants to have time for surfing.



**The Public** - They are OK with science as long as it doesn't take time away from football, baseball and basketball.

They ALL need to be exposed to science.



# The Nerd







**The Enthusiast**





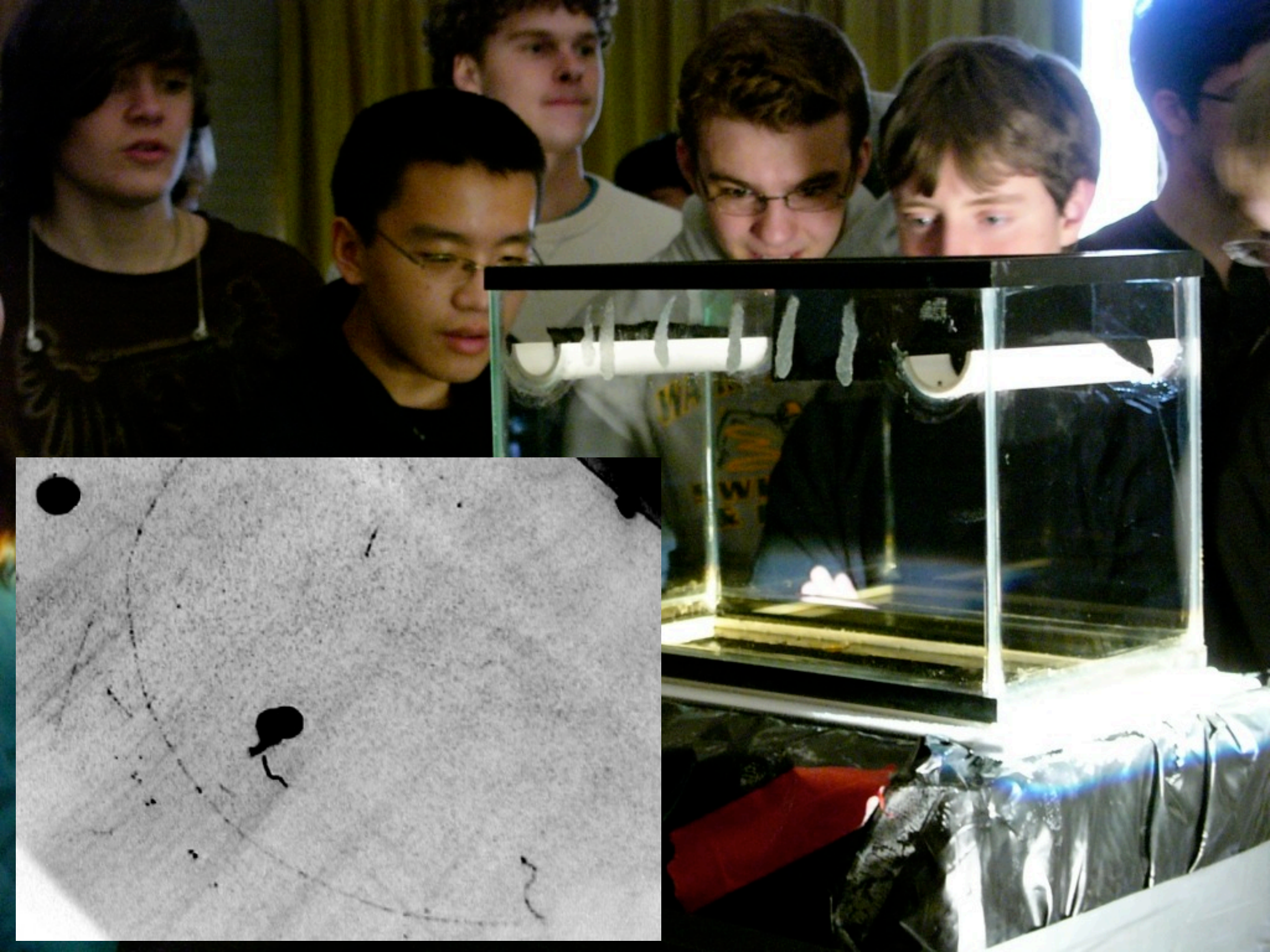
**The Enthusiast**





**The Public**



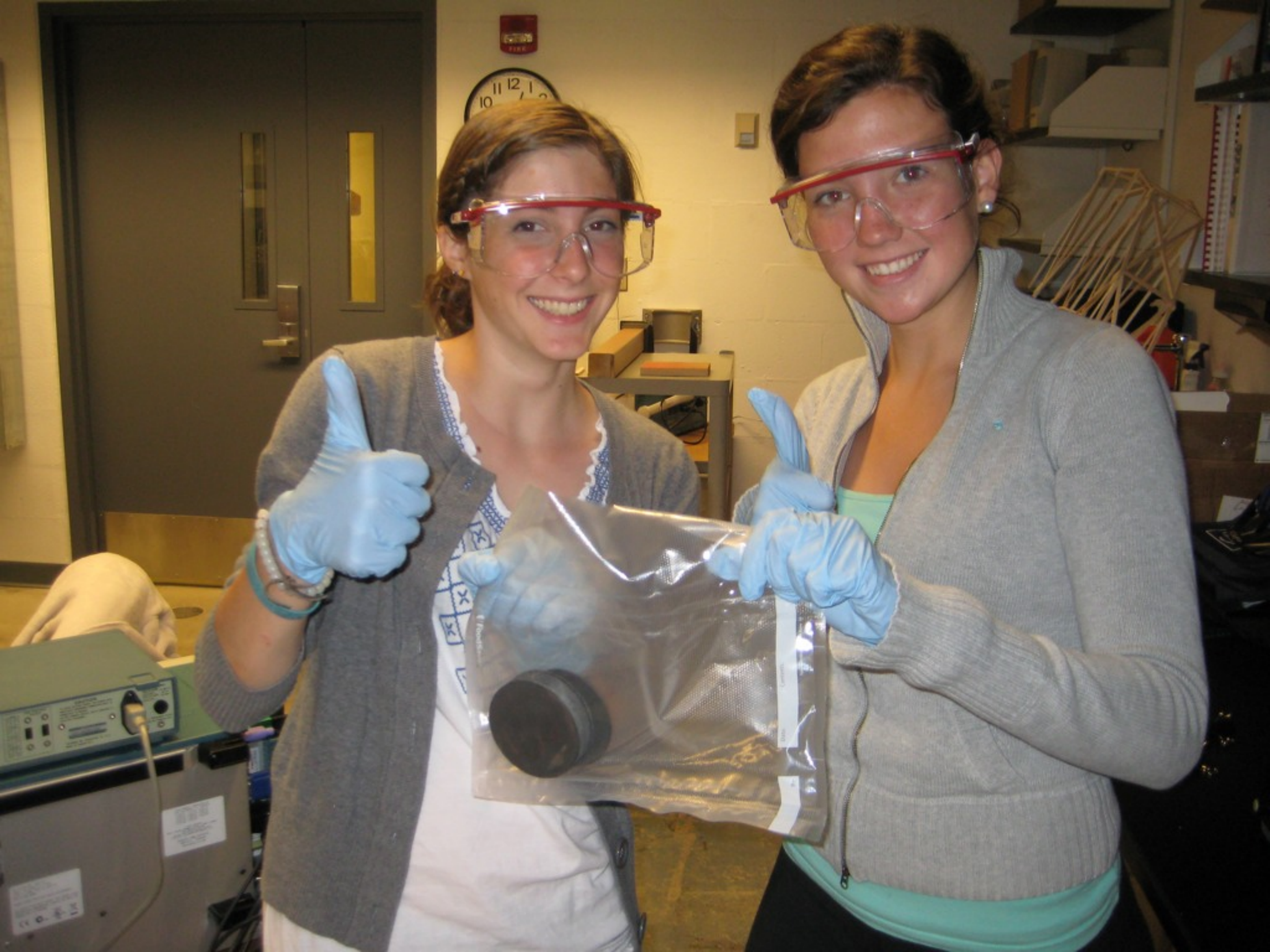






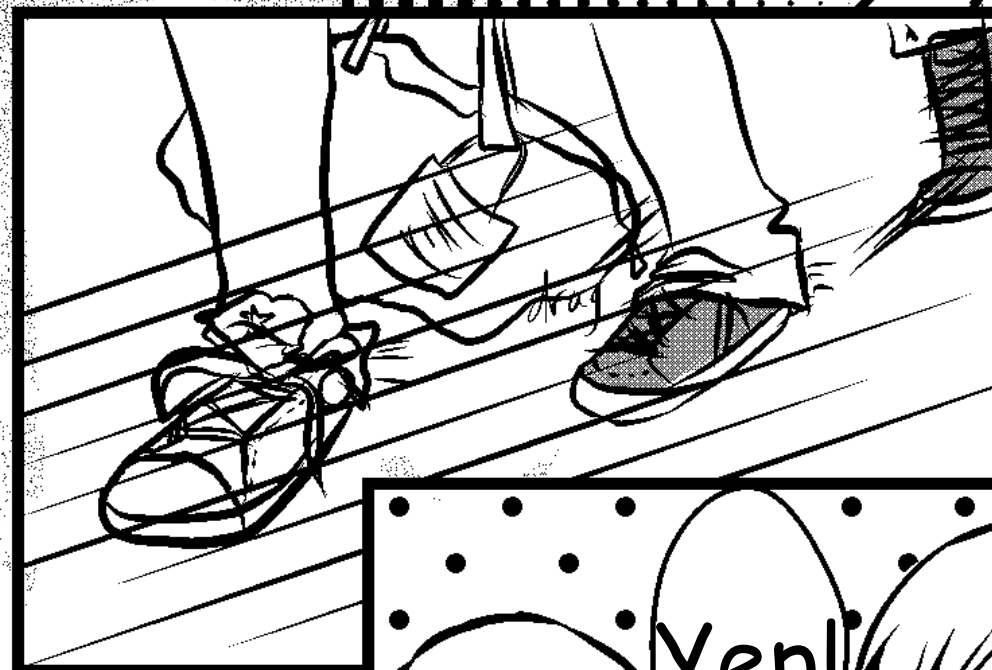
**Research Students:** Significant fraction pursuing science and technology careers. Noticeable population of students who start undergraduate research as freshman. Past students help younger students (via email, social networks, chat, skype).







Hey Megan,  
I wonder how  
real research is...



Yep!

What??

Not sure  
Oma, we are  
Manga  
characters....





Science awareness. Exercise creativity. Proper use of computing tools, e.g. data handling, plots, wiki, collaborative tools. Team work !



Increase of technology use in classroom (vc, poll everywhere, doodle... ), science methodology, participation in scientific events and professional conferences, publish educational papers, organization of physics related events, PhD in Science Education...



Awareness of the current situation of education. Better communication skills. Opportunity to help educators. Many opportunities for outreach events. MARIACHI is a meeting place!



# Summary

- MARIACHI, a forefront experiment built by a collaboration formed by teachers, students and scientists. It is very important for E/O programs to have science as a driver.
- Science results obtained by us sparked a flurry of activities at U of Utah and U of Tokyo. Currently a dedicated radar is being installed at the Telescope Array facility in Delta, Utah.
- Strategies for data analysis involving entire classrooms have been developed by educators. It has educational and scientific value.
- It has generated interest, particularly in small colleges, community colleges, a variety of high schools, and attracted volunteers!
- Where do we go from here?